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Erosive tooth wear

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Article title

Erosive tooth wear: knowledge among young adults and their preferred information sources

Running title

Erosive tooth wear: knowledge and information sources

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Clinical relevance

Scientific rationale for study

Given the irreversible loss of tooth structure that it causes, erosive tooth wear – with a prevalence in children and adolescents around the world is estimated at 30% - can result in functional and aesthetic oral limitations. It is therefore important for people to have an understanding of this threat to their dental health.

Principal findings

Highly educated individuals and individuals who have received dental information in the past score better in terms of knowledge about erosive tooth wear. The young adults preferred to be informed by dental care professionals and not by solely through the Internet or apps.

Practical implications

There is a need to inform young adults about erosive tooth wear and there should be a particular emphasis on delivering information to individuals with lower levels of education. Chairside information in combination with a written, individual, tailored support is the most preferred way of informing young adults.

Abstract

Objectives

The aim of this study was to learn more about levels of knowledge relating to erosive tooth wear and about the most desirable way of disseminating dental information among young adults.

Methods

The research was a cross-sectional study of 331 young adults (20–25 years old) attending 25 dental care practices. Participants were asked to fill out a questionnaire with questions about their background, knowledge relating to erosive tooth wear and the preferred way of acquiring information about erosive tooth wear.

Results

The results showed that there are gaps in the knowledge of young adults about erosive tooth wear. The knowledge score depended on educational level and dental information received in the past. The preferred way of acquiring information was chair side information from an oral health care professional complemented by tailored information in writing.

Conclusion

There is a lack of knowledge among young adults about erosive tooth wear. They prefer to receive information from the oral health care professionals accompanied by tailored information in writing. Further research should focus on developing this tailored information in line with the advice given by the oral health care professional.

Keywords/Mesh terms

Erosion, tooth wear, knowledge, information sources, young adults

Text

Introduction

Tooth wear is a multifactorial condition that leads to the irreversible loss of hard dental tissues (dental enamel, dentine and cementum) and therefore, in turn, to functional and aesthetic oral limitations [1,2,3]. The literature breaks down tooth wear into mechanical wear (attrition and abrasion) and chemical wear (erosion). Both in vitro and in vivo observations show that those mechanisms are rarely found in isolation [3].

Erosive tooth wear is characterised by the direct impact of intrinsic or extrinsic acids [2,3,4] on hard dental tissues. Extrinsic acids come from food products, including juices, soft drinks, energy drinks, sports drinks and fruit acid; intrinsic acids enter the mouth as a result of vomiting or reflux disease [5,6]. Even though the literature shows some ambiguous results, the excessive consumption of acid, and often carbonated, beverages is recognised as an important extrinsic factor in erosive tooth wear among young people [2,7,8,9,10]. In addition to these risk factors, protective factors such as the consumption of milk products, the use of fluoride toothpaste and biological factors such as the quantity and quality of saliva have been described [11,12,13,14,15].

Signs of erosive tooth wear can be apparent at an early age [10,16,17]. In the Netherlands, the prevalence of erosive tooth wear in children aged 11-12-years was estimated to be between 3 and 5%, rising to about 30% at the age of 17 [16]. Gambon et al. [16] concluded that the prevalence of erosive tooth wear among adolescents aged 11-17 years in the Netherlands had increased during the previous two decades. A recent systematic review stated an estimated prevalence of erosive tooth wear in children and adolescents around the world of 30% [10]. It should be noted that the studies included in the review were very heterogeneous, and that different clinical indices were used for erosive tooth wear [10].

Bartlett et al. [18] showed that 29% of adults aged 18-35 years in six European countries had signs of tooth wear (BEWE score 2 or 3 [19]). There were, however, major variations between different countries, with the highest levels of tooth wear being observed in the United Kingdom (54%) and the lowest in Finland and Latvia/Estonia (18%) [18]. An epidemiological study of adults in the Netherlands in 2013 using a 5-point ordinal occlusal/incisal grading scale for tooth wear showed prevalences of 13% for mild tooth wear, 80% for moderate tooth wear, and 6% for severe tooth wear. These prevalences were 31%, 65% and 2% respectively in the youngest age group (25-34 years) and 4%, 82% and 12% in the oldest age group (65-74 years) for mild, moderate and severe tooth wear. There was a tendency towards more tooth wear in older age groups than in younger age groups, in males than in females, and in individuals with a lower socioeconomic status than in those with a high socioeconomic status [4]. One may conclude that tooth wear is a common condition in the Dutch population, even though severe tooth wear is considered to be rare.

The effect of the chemical component is assumed to be more significant than the role of mechanical factors in tooth wear in young people [2,7,8,9,10]. The chemical component benefits from adequate dietary habits. A review by Harris [20] concluded that there was tentative evidence that informing patients in dental settings about the consequences of dietary habits resulted in a behavioural change.

In an ideal situation, children learn good oral habits from their parents, school and dental staff. When they are older, they should have enough knowledge and good dental behaviour of their own. Research from Norway looking at young adults (aged 18-20) showed that 88-93% had heard about erosive tooth wear at some time [21, 22]. A study in a dental practice in Northwest England of 105 patients aged 21-78 years showed that only a third of the questions about erosive tooth wear were answered correctly [23].

Dental information is available through many information channels these days: from dental care professionals during dental appointments, through family and friends, school or from the Internet and apps. Furthermore, search options on the Internet are unlimited.

However, little is known about patients' preferences for different information channels. Previous research concluded that the use of the Internet as a source of information depends on factors such as age, coping styles, the educational level of the patient and the reliability of the source [24].

Since erosive tooth wear can start at a young age, young people should be aware of the causes and consequences of erosive tooth wear. In this study, therefore, we focused on what young adults know about the type of tooth wear caused by chemical erosion.

The aims of the study were to establish a picture of (1) levels of knowledge about erosive tooth wear among young adults (aged 20 to 25 years) and (2) how young adults want to receive information about a dental topic such as erosive tooth wear.

Materials and methods

Participants (aged 20–25) were recruited at 25 dental clinics in the northern part of the Netherlands between February and September 2016. The 25 dental clinics that agreed to participate in this study were affiliated to a practice-based research network in this part of the Netherlands. On behalf of each dental clinic, one participating dentist was asked to give some details about the organisation of the clinic (number of dentists, oral hygienists and prevention assistants) and their usual way of providing their patients with information about erosive tooth wear.

A total of 10,565 young adults were potentially eligible for inclusion in the study in those 25 dental clinics. The dental clinics were asked to recruit the first fifteen young adults scheduled for an oral health check-up. The subjects were free to take part in the study or not and they were asked to give reasons if they declined. This study was not subject to the provisions of the Medical Research Involving Human Subjects Act. There was therefore no need for approval from a medical ethics committee. The study met all requirements of the Personal Data Protection Act.

Not all 25 dental clinics were able to collect data from 15 young adults in the set period of time. A total of 342 individuals were approached: one refused due to dental fear, two refused due to a lack of time and eight questionnaires were excluded afterwards because the ages of the respondents were not in the correct range. A total of 331 individuals participated in the study (Figure 1).

Data were obtained using paper questionnaires that consisted of 27 questions: seven questions about the background of the participant (gender, education, living and working conditions), one question about the frequency of dental visits, thirteen questions about the knowledge of erosive tooth wear, and six questions about preferences relating to the acquisition of dental information. The questions can be found in in table 1. Most questions were formulated as multiple-choice question in which one response was correct, one response was 'I don't know' and one or two responses were false. The questionnaire was pretested on three individuals and found to be valid for the aim of the study.

Educational level was classified as low or high on the basis of the Dutch education system. High education was defined as senior general secondary education (in Dutch: HAVO (Hoger Algemeen Voortgezet Onderwijs) or higher. All other education was defined as low education.

Frequency of dental check-ups was allocated to three categories: (1) Rarely ('I do not go to the dentist' / 'I only go when I have a problem or pain'), (2) 'once a year', (3) 'twice a year or more often'.

A total knowledge score was calculated by counting the number of correctly answered questions about erosive tooth wear. Two questions were about the aetiology of erosive tooth wear, one question was about the consequences and ten questions were about determinant factors. One of those questions was about diet and erosive tooth wear and it included twelve sub-questions with three response options for each listed food product: 'causes wear', 'doesn't cause wear', 'I don't know' (table 1). Individual total knowledge scores could therefore vary from 0 to 24.

Statistical analyses

Since participants were recruited through dental clinics, the clustering of the results from subjects at practices could not be ruled out; patients attending the same dental clinic could have similar knowledge scores because identical information was given by the same dental care professional. To check whether an adjustment was needed for the effect of clustering, a multi-level model was tested using MLwiN. The intra-class correlation (which is the ratio of the variance between practices to total variance) was zero, leading to the conclusion that there was no clustering and the observations could be treated as independent units.

Frequency distributions, medians and 25-75% interval were used to describe the characteristics of the study population. Differences between groups were tested using the Pearson's chi-square test. Since the distribution of the knowledge scores was skewed, non-parametric tests (Mann-Whitney U test and the Kruskal-Wallis test) were used. To adjust for relevant factors, a linear regression analysis was performed with knowledge score as the dependent variable and the level of education, having received information previously (yes or no), gender, living condition, and frequency of dental check-ups as the independent variables. The statistical analyses were performed using SPSS version 23.

Results

Characteristics of the dental care practices

There were 76 dentists, 35 oral hygienists and 58 prevention assistants working in the 25 dental clinics studied. Information about erosive tooth wear was provided in all dental clinics in the form of chairside information and sixteen dental clinics combined this with leaflets. Eleven dental clinics advised the patient to visit the website of the dental clinic, eight recommended other websites, two recommended an app and one sent emails to patients with information.

Young adults

The participants were equally distributed between the six ages (14-18% per year of birth) in the sample: 57% were women and 43% were men; 51% had received high education, 49% a low education; exactly 50% were living with their parents, the other half were living independently; 71% had a job for 24 hours a week on average, 2% had an unpaid job and 27% had no work at all. Sixty-five percent were in school. Six percent visited the dental clinics rarely, 30% once a year and 65% twice a year or more.

Knowledge score

Figure 2 shows the distribution of the knowledge scores. The median knowledge score was 16 with a 25-75% interval of 13-18. Nobody scored the maximum score of 24. Seventy-one percent of the respondents knew the definition of erosive tooth wear, 52% knew the cause and 42% knew the effects of it (Table 1). Almost everyone was aware that fruit juice, sports drinks, energy drinks and cola products are erosive and that water and mineral water are not. However, the acidic effect of an apple (61% answered correctly) and fruit tea (56% correctly) was less well known. The gaps in knowledge about erosive tooth wear mostly related to the effects of a dry mouth, the effect of drinking water immediately after food/drink consumption, the non-erosive effect of yogurt and the number of eating and drinking occasions allowed according to the current guidelines [26]. Only a very small group of participants (9%) knew about the recommendation not to eat or drink more than seven times a day.

There was no statistically significant difference between the knowledge scores of men and women or between participants who were living together with their parents or were living on their own. There was a statistically significant difference between the knowledge levels of individuals with high and low levels of education (median scores 16 and 15, respectively; $Z = -2.691$, $P = 0.007$), in participants who had received information about tooth wear from their dentist or oral hygienist and participants who had not (median scores 16 and 15, respectively; $Z = -2.504$, $p = 0.012$) and in participants who had searched at some time for dental information and those who had not (median scores 17 and 15.5, respectively; $Z = -$

3.012, $p = 0.003$). There was a statistically significant difference between the knowledge scores of people with the different frequencies of dental check-ups mentioned above: rarely, once a year or twice a year or more (median scores, respectively, 14, 16 and 16; $H = 7.973$; $p = 0.019$). Having received information previously and having a high level of education had a statistically significant effect on knowledge scores when adjusted for the other factors. Knowledge scores in these participants were higher than the scores of their counterparts with low levels of education who had not received information previously (Table 2) (linear regression analysis educational level $B = 1.080$, $t = 2.534$, $p = 0.012$ / / information provided $B = 1.054$, $t = 0.144$, $p = 0.013$).

Dental information

Half of the young adults (50%) answered that they never had received specific information about erosive tooth wear from a dentist or oral hygienist. Two-thirds of the young adults had never searched for dental information; a third had. There were no statistically significant differences between participants with high and low levels of education in terms of searching for information (37% versus 30%, Chi-square = 1.713; $Df = 2$, $p = 0.191$).

Three-quarters of the participants (77%) had received a leaflet from the dentist or oral hygienist at some time; 59% of them had taken a quick look or not read the leaflet at all (Figure 3).

The answer to the hypothetical question of how young adults would search for information about tooth wear (multiple answers allowed) was that 80% would use an Internet search engine and 56% would ask the dentist. Very few would use an app (Table 3). Individuals with a high educational level were more likely to use an Internet search site than individuals with a low educational level (55% versus 45% Chi-square = 7.690; $Df = 2$, $p = 0.006$).

When asked in what form they would prefer to receive information from the dentist or oral hygienist (multiple answers possible), the respondents said that information from the dental care professional was the most desirable way and an app the least (Table 4).

Common combinations were chairside information from the dental care professional with a brochure or an email with tailored details. This concurred well with the fact that young adults said that they would remember oral information best (71%) in combination with reading tailored information (51%).

Discussion

The literature breaks down tooth wear into mechanical wear (attrition and abrasion) and chemical wear (erosion). Both in vitro and in vivo observations show that those mechanisms rarely act in isolation and they are often mutually reinforcing [3,25]. The chemical component is assumed to have more of an effect than the mechanical factors in tooth wear in young people. This chemical component could benefit from adequate dietary habits. In this study, therefore, we focused on the knowledge of young adults of the type of tooth wear caused by the chemical (erosive) component.

It can be concluded that there are gaps in knowledge about erosive tooth wear. Half of the participants gave incorrect answers to more than one third of the questions. It was, however, encouraging that questions about effects of fruit juices, sports drinks, energy drinks, cola, water and mineral water were answered correctly by almost all participants. The knowledge scores of the young adults did not vary between the different dental clinics (no clustering). There seemed to be no differences between dental clinics in terms of the amount of information given to patients about erosive tooth wear or in terms of the approach to delivering that information.

The definition of erosive tooth wear was known in 71%; however, the causes and effects were not. Research from Norway showed a greater awareness of erosive tooth wear: 88-94% had heard about erosive tooth wear [14,21].

There were obvious gaps in knowledge about erosive tooth wear: it was very noticeable that the current guidelines [26] about having no more than seven food/drink consumptions daily (except for drinking water, coffee and tea without milk or sugar) was known to 9% only. This knowledge is important in the context of preventing permanent damage to the dentition as a result of erosive tooth wear.

Previous research has shown that young adults acquire most dental information from an oral health care professional, school or their social environment [27]. Our research also showed that chairside information from an oral health care professional, complemented by written information in a folder or an email, was the preferred source for young adults. All participating practices said that they supplied chairside information about tooth wear. Not all practice backed this information up with a written brochure. However, not all people who received a brochure actually to read it. The probability of a brochure being read apparently increases when the content is tailored to the patient and applies to their personal dental health.

Previous research about the effect of online sources of information has shown an increase in dental knowledge among the participants [28,29,30]. Most young adults (67%) in our study seemed not to use these resources on their own initiative, possibly because they never had a reason and/or need to do so. Given the times we live in, we were surprised by one finding: the use of, and the demand for, apps as a source of information was particularly low in this age category and so there is no point in developing apps for the purposes of providing information about erosive tooth wear. It is not possible to determine whether this finding also applies to other dental topics and/or other age groups.

The knowledge scores depended on the educational level of the participants. The social gradient in oral health outcomes is often seen in the literature [31]. People with a lower socioeconomic status are known to be more vulnerable to oral diseases. Extra efforts to inform the young adults with lower levels of education about erosive tooth wear are strongly recommended.

Strengths and limitations of the study

An important strength of this study is that the inclusion of the young adults enrolled in dental practice was random. It targeted the first fifteen patients aged 20 to 25 to attend the practices and so it is assumed that there was no selection bias. The additional strengths are the large sample size and the very low number of people who refused to participate.

A limitation of our study is the focus on young adults who actually visited a dental clinic. Dental care in the Netherlands is delivered through private dental clinics. Adults (18+) have to pay out of pocket or they may be insured voluntarily. The results of this study showed that young adults who rarely visited the dental clinic and/or never received information about tooth wear had lower knowledge scores than those who went regularly and/or had received information. It could therefore be assumed that young adults who do not visit a dental clinic at all will have lower knowledge scores than the young adults who visit their dentist regularly. Our results might therefore be overestimating the knowledge about erosive tooth wear among young adults in the Netherlands.

Another limitation is that the study was performed as part of the Dental Practice-based Research Network Northern Netherlands (DPRN-NN) project. Participation in the DPRN-NN is voluntary. It may be assumed that dental clinics that participate in studies like ours are probably were more prevention minded and that their patients probably informed more by the dental professionals than in other clinics. This could also result in an overestimation of the knowledge scores in our study.

Conclusion

There is a need to inform young adults about erosive tooth wear and to focus in particular on delivering information to individuals with lower levels of education. Furthermore, it emerged that chairside information, in combination with a written, individual, tailored information, young adults' preferred source of dental information. Further research should focus on developing tailored written support in line with the guidance given by the oral health care professionals. This would meet patient wishes about delivery of the information. A straightforward system is needed for delivering tailored information to the patient in a simple format, with a record being saved in the patient's file in the dental software.

This approach to informing patients about erosive tooth wear should be tested for feasibility and effectiveness.

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Table 1. Answers to the knowledge questions scored as correct answers, incorrect answers and 'I don't know' and presented as percentages. The correct answers are given between brackets. Numbers in bold show questions answered incorrectly by more than half of the participants.

Question	n	True	False	I don't know
		%	%	%
What is another name for tooth wear? (Erosion)	326	71	9	20
What causes tooth wear? (Acids in your food and drinks)	327	52	37	12
What are the consequences of tooth wear? (Teeth become shorter)	325	42	39	19
Fluoride in toothpaste makes teeth stronger. (Yes)	328	72	13	16
Brushing your teeth immediately after drinking orange juice causes more tooth wear. (Yes)	327	62	13	25
State whether the following products cause tooth wear.				
Water (no)	328	97	1	2
Mineral water (no)	326	91	3	5

English blend tea (no)	327	64	26	10
Fruit tea (yes)	323	56	30	14
Milk (no)	327	58	24	18
Yogurt (no)	327	34	45	21
Fruit juice (yes)	328	88	6	6
Sport drink (yes)	328	92	3	5
Energy drink (yes)	329	97	1	2
Cola (yes)	329	97	2	2
Apple (yes)	327	61	21	17
Cheese (no)	328	50	23	27
Which way of drinking is most likely to cause tooth wear? (If you keep the fizzy drink in your mouth for a long time before you swallow)	327	74	14	12
Which way of drinking during exercise gives the greatest risk of tooth wear? (Sport drink during exercise)	321	44	31	26
What effect does a dry mouth have in the process of tooth wear? (With a dry mouth you get tooth wear faster)	320	37	24	39
You have less chance of tooth wear when you drink a glass of water immediately after drinking cola. (Yes)	321	43	32	25
You have less chance of tooth wear if you drink milk instead of cola. (Yes)	321	81	5	13

What is the maximum number of eating and drinking occasions in one day? (7x)	320	9	50	42
Tooth wear can occur if you often have to vomit. (Yes)	321	77	7	17

Table 2. Effect of gender, living situation, frequency of dental check-ups, educational level and previously received information on knowledge scores (linear regression analysis).

	b*	t	p
Constant	6.988	2.640	0.009
Gender (reference: male)	0.327	0.757	0.450
Children (reference: yes)	1.085	0.954	0.341
Work (reference: yes)	-0.347	-1.483	0.139
Search for dental information (reference: no)	0.688	1.533	0.126
Living situation (reference: on their own)	-0.121	-0.285	0.776
Frequency of dental check-ups (reference: rarely)	0.636	1.865	0.063
Educational level (reference: low)	1.080	2.534	0.012
Information received previously (reference: no)	1.054	0.144	0.013

b* standardised regression coefficient; $F(8.24) = 3.386$; $R^2 = 0.084$.

Table 3. Sources that young adults (n = 320) would use to find information about tooth wear

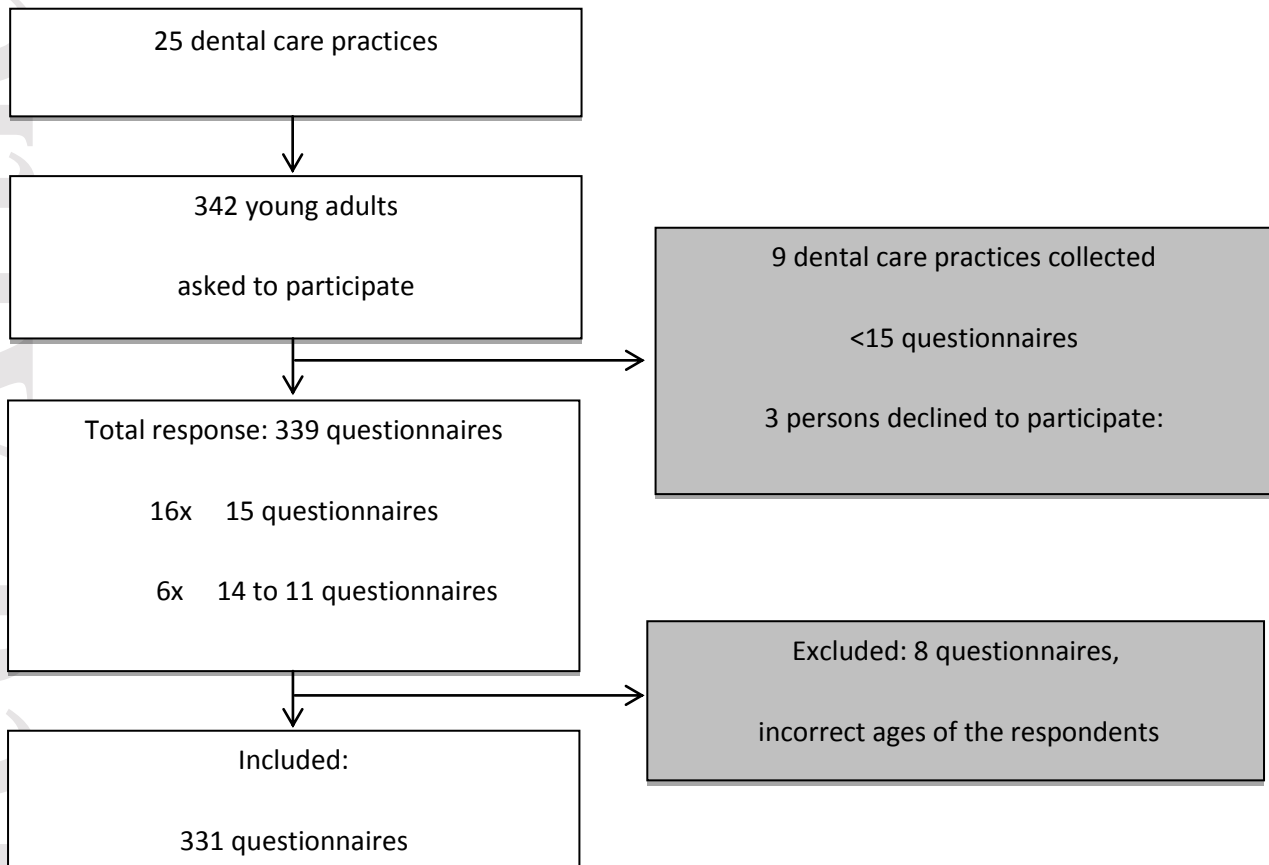
	n	%
Internet search engine	257	80
The dentist	178	56
Their parents	75	23
Website dentist	75	23
Other website	41	13
Friends	22	7
App	8	3
Ivory Cross App	7	2
Other	4	1

Table 4. Young adults' preferred way of receiving information (n = 319)

	n	%
Chair side information	257	81
Brochure	125	39
Mail with information	88	28
Referral to website	59	19
Recommended app	24	8
Other	4	1

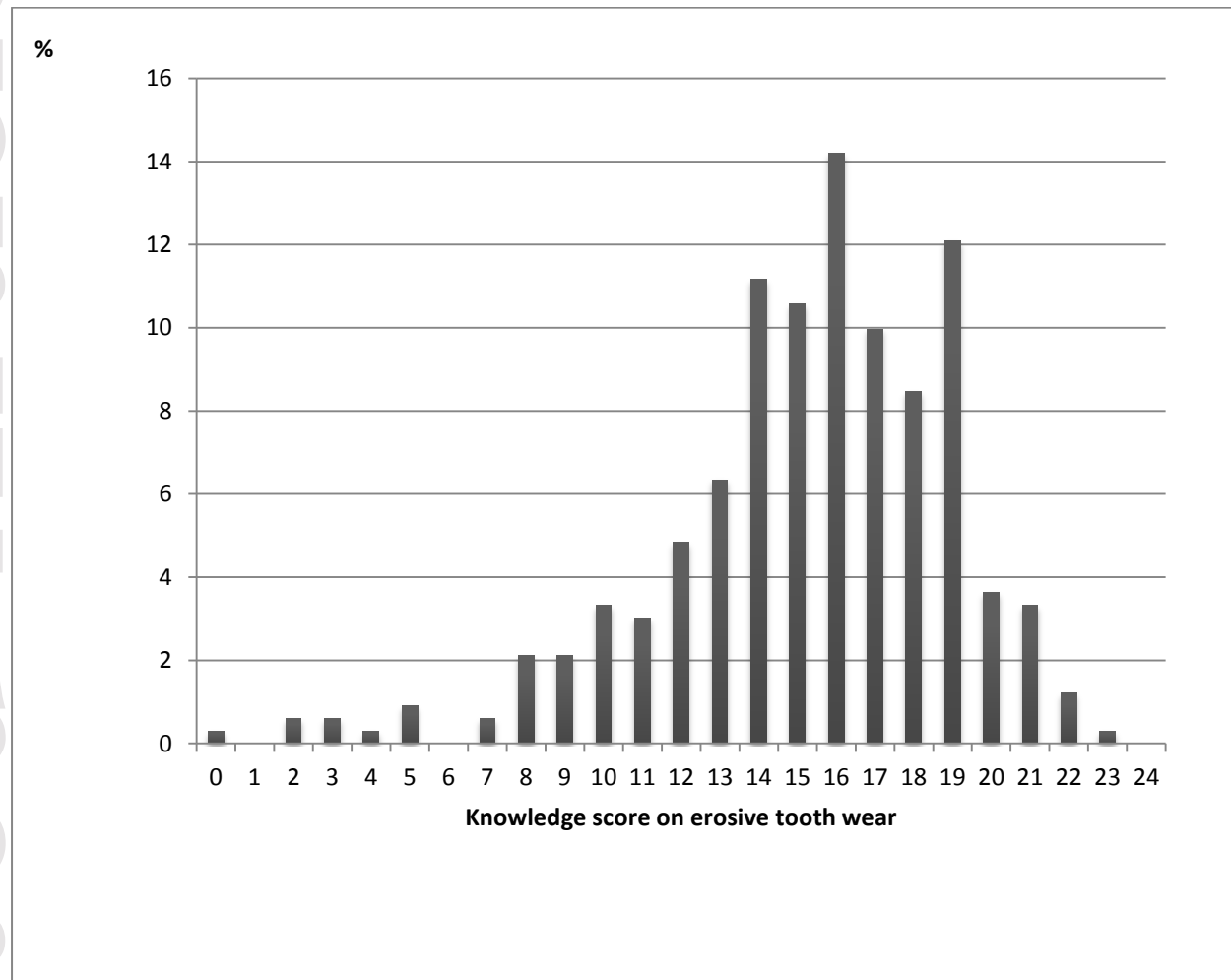
Name image file: Figure 1. Flow diagram participation

Figure 1. Schematic representation of participation, failure to participate and exclusion.



Name image file: Figure 2. Knowledge score on erosive tooth wear

Figure 2. Frequency distribution of the participants knowledge scores (n = 331)



Name image file: Figure 3. Reading brochures

Figure 3. Percentage of participants and how they read a received brochure (n = 244).

